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MISSILE DEFENSE

Opportunity to Refocus on Strengthening Acquisition Management

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May 9, 2013

MISSILE DEFENSE

Opportunity to Refocus on Strengthening Acquisition Management

Why GAO Did This Study

In order to meet its mission, MDA is developing a highly complex group of systems comprised of land-, sea-, and space-based sensors to track missiles, as well as ballistic missile interceptors and a battle management system. These systems can be integrated in different ways to provide protection in various regions of the world. Since its initiation in 2002, MDA has been given a significant amount of flexibility in executing the development and fielding of the ballistic missile defense system. This statement addresses recent MDA progress and the challenges it faces with its acquisition management. It is based on GAO's April 2013 report and reports on missile defense issued from September 2008 through July 2012.

What GAO Recommends

GAO makes no new recommendations in this statement. In the April 2013 report, GAO made four recommendations to DOD to ensure MDA (1) fully assesses alternatives before selecting investments, (2) takes steps to reduce the risk that unproven target missiles can disrupt key tests, (3) reports full program costs, and (4) stabilizes acquisition baselines. DOD concurred with two recommendations and partially concurred with two, stating the decision to perform target risk reduction flight tests should be weighed against other programmatic factors and that its current forum for reporting MDA program costs should not include non-MDA funding. GAO continues to believe the recommendations are valid as discussed in that report.

What GAO Found

The Department of Defense's (DOD) Missile Defense Agency (MDA) has made some recent progress gaining important knowledge for its Ballistic Missile Defense System (BMDS) by successfully conducting several important tests. In addition, the agency made substantial improvements to the clarity of its cost and schedule baselines since first reporting them in 2010, and declared the first major deployment of U.S. missile defense in Europe operational in December 2011. MDA also took steps to reduce acquisition risk by decreasing the overlap between technology and product development for two of its programs.

MDA faces considerable challenges in executing acquisition programs; strengthening accountability; assessing alternatives before making new investment commitments; developing and deploying U.S. missile defense in Europe and using modeling and simulations to understand capabilities and limitations of the BMDS. The appointment of a new director for MDA provides an opportunity to address these challenges. More specifically:

- Interceptor production for three of MDA's systems has been significantly disrupted during the past few years due to high-risk acquisition strategies which have resulted in delaying planned deliveries to the warfighter, raising costs, and disrupting the industrial base. Further, MDA continues to follow high-risk acquisition strategies for other programs. For example, its Targets and Countermeasures program is adding risk to an upcoming complex, costly operational flight test involving multiple MDA systems because it plans to use unproven targets.
- While MDA made substantial improvements to the clarity of its reported cost and schedule baselines, MDA's estimates are not comprehensive because they do not include costs from military services in reported life-cycle costs for its programs. Instability due to MDA's frequent adjustments to its acquisition baselines makes assessing progress over time using these baselines extremely difficult and, in many cases, impossible.
- While MDA has conducted some analyses that consider alternatives in selecting which acquisitions to pursue, it did not conduct robust analyses of alternatives for two of its new programs, both of which were recently proposed for cancellation.
- During the past several years, MDA has been responding to a mandate from the President to develop and deploy new missile defense systems in Europe for the defense of Europe and the United States. GAO's work continues to find that a key challenge facing DOD is to keep individual system acquisitions synchronized with the planned deployment time frames.
- MDA has also struggled for years to develop the tools—the models and simulations—to understand the capabilities and limitations of the individual systems before they are deployed. While MDA recently committed to a new approach that could enable them to credibly model individual programs and system-level BMDS performance, warfighters will not benefit from this effort until after the first two of the currently planned three phases for U.S. missile defense in Europe have been deployed in 2011 and 2015 respectively.

View [GAO-13-604T](#). For more information, contact Cristina Chaplain at (202) 512-4841 or chaplainc@gao.gov.



Chairman Udall, Ranking Member Sessions, and Members of the Subcommittee:

I am pleased to be here today to discuss the progress made and challenges that remain for the Department of Defense's (DOD) Missile Defense Agency (MDA) in developing and fielding the Ballistic Missile Defense System (BMDS). Since MDA was established in 2002, it has spent over \$90 billion to provide protection from enemy ballistic missiles by developing battle management systems, sensors that identify incoming threats, and missiles to intercept them. MDA plans to spend about \$7.5 billion per year through 2018. Since its inception, MDA has been operating in an environment of tight time frames for delivering capabilities—first with a presidential directive in 2002 and then with a presidential announcement in 2009 on U.S. missile defense in Europe. It is now also operating in an environment of growing budgetary constraints, which have already necessitated tough trade-off decisions and will require additional steps to reduce acquisition risk. At the same time, MDA is undergoing significant transition. In addition to a recent change in the agency's leadership, MDA is responding to the Secretary of Defense's March 2013 announcement to increase the planned numbers of ground-based interceptors designed to protect the United States as well as to changes in plans for U.S. missile defense in Europe.

Since the 2002 National Defense Authorization Act, we have been mandated to prepare annual assessments of MDA's progress toward its acquisition goals.¹ The National Defense Authorization Act for Fiscal Year 2012 required us to report on our assessment of the extent to which MDA has achieved its stated acquisition goals and objectives, as reported through their acquisition baselines, and also to include any other findings and recommendations on MDA acquisition programs and accountability as appropriate.² We recently issued our report responding to this

¹National Defense Authorization Act for Fiscal Year 2002, Pub. L. No. 107-107, § 232(g) (2001); Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Pub. L. No. 108-375, § 233 (2004); National Defense Authorization Act for Fiscal Year 2006, Pub. L. No. 109-163, § 232; John Warner National Defense Authorization Act for Fiscal Year 2007, Pub. L. No. 109-364, § 224 (2006); and National Defense Authorization Act for Fiscal Year 2008, Pub. L. No. 110-181, § 225.

² Pub. L. No. 112-81, § 232 (2011).

mandate.³ This testimony highlights our findings from that report as well as relevant findings from several of our prior reports on missile defense issued from September 2008 through July 2012, particularly as they relate to the progress MDA made this year in reducing acquisition risks and the challenges that still face MDA.⁴

To assess MDA's progress and related challenges, we examined the acquisition accomplishments of individual missile defense programs and supporting efforts that MDA is currently developing and fielding. We conducted this work in accordance with generally accepted government auditing standards. Additional information on our scope and methodology is available in our April 2013 and prior issued reports.

Background

MDA's BMDS is being designed to counter ballistic missiles of all ranges—short, medium, intermediate, and intercontinental. Because ballistic missiles have different ranges, speeds, sizes, and performance characteristics, MDA is developing multiple systems that, when integrated, provide multiple opportunities to destroy ballistic missiles before they can reach their targets. The BMDS architecture includes space-based sensors, ground- and sea-based radars, ground- and sea-based interceptor missiles, and a command and control, battle management, and communications system to provide the warfighter with the necessary communication links to the sensors and interceptor missiles.

Table 1 provides a brief description of individual BMDS systems, which MDA refers to as elements of the BMDS. As noted in the table, two

³GAO, *Missile Defense: Opportunity to Refocus on Strengthening Acquisition Management*, [GAO-13-432](#) (Washington, D.C.: Apr. 26, 2013).

⁴[GAO-13-432](#); GAO, *Missile Defense: Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, [GAO-12-486](#) (Washington, D.C.: Apr. 20, 2012); *Schedule Best Practices Provide Opportunity to Enhance Missile Defense Agency Accountability and Program Execution*, [GAO-12-720R](#) (Washington, D.C.: July 19, 2012); *Space and Missile Defense Acquisitions: Periodic Assessment Needed to Correct Parts Quality Problems in Major Programs*, [GAO-11-404](#) (Washington, D.C.: June 24, 2011); *Missile Defense: Actions Needed to Improve Transparency and Accountability*, [GAO-11-372](#) (Washington, D.C.: Mar. 24, 2011); *Defense Acquisitions: Many Analyses of Alternatives Have Not Provided a Robust Assessment of Weapon System Options*, [GAO-09-665](#) (Washington, D.C.: Sept. 24, 2009); *Defense Acquisitions: Sound Business Case Needed to Implement Missile Defense Agency's Targets Program*, [GAO-08-1113](#) (Washington, D.C.: Sept. 26, 2008).

programs were proposed for cancellation in April 2013 as part of DOD's Fiscal Year 2014 President's Budget Submission.

Table 1: Description of Selected Ballistic Missile Defense System (BMDS) Elements and Supporting Efforts

BMDS element/supporting effort	Description and key components
Aegis Ballistic Missile Defense (BMD) with Standard Missile-3 (SM-3) Block IA and Block IB ^a	Aegis BMD is a sea-based system developed for ballistic missile defense and other missions. MDA is developing several versions of SM-3 and associated ship-based software and processors. The first two variants of SM-3 missiles are referred to as Block IA and Block IB. The SM-3 Block IB features additional capabilities over the Block IA to identify, discriminate, and track objects during flight.
Aegis Ashore	A land-based, or ashore, version of Aegis BMD initially using SM-3 Block IB missiles, with plans to use various versions of SM-3 missiles and Aegis weapon system software as they become available.
Aegis BMD SM-3 Block IIA	The SM-3 Block IIA is planned to be larger than the SM-3 Block IB and is planned to have increased velocity, range, and discrimination capabilities.
Aegis BMD SM-3 Block IIB	The SM-3 Block IIB was planned to address different threats and have more advanced capabilities than earlier SM-3 versions. Key components had not yet been finalized before DOD proposed canceling the program in April 2013 as part of its Fiscal Year 2014 President's Budget Submission.
BMDS Sensors	MDA has fielded and/or upgraded a variety of sensors that support various elements of the BMDS including: the Army Navy/Transportable Radar Surveillance and Control Model 2 (AN/TPY-2) radar; the Sea-Based X-Band radar; upgraded early warning radars; and the Cobra Dane radar.
Command, Control, Battle Management, and Communications (C2BMC) ^a	A global network that links and integrates individual missile defense elements. It also allows users to plan ballistic missile defense operations, see the battle develop, and manage networked sensors and weapon systems.
Ground-based Midcourse Defense (GMD)	A ground-based missile defense system with interceptors located at Fort Greely, Alaska and Vandenberg, California. The interceptor consists of a 3-stage booster with a kill vehicle on top that can steer itself into the threat missile to destroy it. There are currently two versions of the kill vehicle: the Capability Enhancement-I (CE-I) and the upgraded design known as the Capability Enhancement-II (CE-II).
Precision Tracking Space System (PTSS)	A new constellation of nine satellites planned to provide high-quality track information on threat missiles to other ballistic missile defense systems, DOD proposed canceling the program in April 2013 as part of its Fiscal Year 2014 President's Budget Submission.
Targets and Countermeasures	MDA develops and manufactures highly complex targets to present realistic threat scenarios during BMDS flight tests. Our testimony focuses on medium-range air-launched targets being flown for the first time in fiscal year 2013.
Terminal High Altitude Area Defense (THAAD)	A mobile, ground-based missile defense system organized as a battery which includes interceptors, launchers, an AN/TPY-2 radar, a fire control and communications system, and other support equipment.

Source: Missile Defense Agency (data); GAO (presentation).

^aDetails on the acquisition progress of the Aegis BMD SM-3 Block IA and C2BMC elements were not covered in our April 2013 report.

When MDA was established in 2002, the Secretary of Defense granted it exceptional flexibility to set requirements and manage the acquisition of

the BMDS in order to quickly deliver protection against ballistic missiles. This decision enabled MDA to rapidly deliver assets but we have reported that it has come at the expense of transparency and accountability.⁵ Moreover, to meet tight deadlines, MDA has employed high-risk acquisition strategies that have resulted in significant cost growth, schedule delays, and in some cases, performance shortfalls. Examples of key problems we have cited in reports in recent years are highlighted below.

- In recent years, MDA has experienced several test failures. These, as well as a test anomaly and delays, disrupted MDA's flight test plan and the acquisition strategies of several components.⁶ Overall, these issues forced MDA to suspend or slow production of three out of four interceptors being manufactured. The GMD program in particular has been disrupted in its attempts to demonstrate the CE-II interceptors by two test failures. As a result of a failed flight test in January 2010 due to an assembly process quality issue, MDA added a retest designated as Flight Test GMD-06a (FTG-06a). However, this retest also failed in December 2010 due to the effects of vibration on the kill vehicle's guidance system. As a result of these failures, MDA decided to halt GMD flight testing and restructure its multiyear flight test program, halt production of the GMD interceptors, and redirect resources to return-to-flight testing activities. Additionally, as we reported in April 2013, the costs to demonstrate and fix CE-II capability have grown from \$236 million to over \$1.2 billion and are continuing to grow.⁷
- MDA acquisitions have faced significant cost growth, schedule delays, and/or performance shortfalls due to a highly concurrent acquisition approach.⁸ Concurrency is broadly defined as the overlap between technology development and product development or between product development and production. While some concurrency is understandable, committing to product development before requirements are understood and technologies are mature or committing to production and fielding before development is complete is a high-risk strategy that often results in performance shortfalls,

⁵GAO-11-372 and GAO-12-486.

⁶GAO-12-486.

⁷GAO-13-432.

⁸GAO-12-486 and GAO-13-432.

unexpected cost increases, schedule delays, and test problems. High levels of concurrency were present in MDA's initial efforts and remain present in current efforts.

- There has been limited visibility into cost and schedule progress associated with the BMDS. We have reported on the limited usefulness of MDA's acquisition baselines for oversight due to (1) a lack of clarity, consistency, and completeness; (2) a lack of high-quality supporting cost estimates and schedules; and (3) instability in the content of the baselines.⁹
- MDA has made limited progress in developing the individual system models it uses to assess performance of the BMDS elements and linking those models.¹⁰ Models and simulations are critical to understanding BMDS capabilities. The complex nature of the BMDS, with its wide range of connected elements, requires integrated system-level models and simulations to assess its performance in a range of system configurations and engagement conditions.
- Quality issues have also impeded missile defense development in recent years.¹¹ These were due to workmanship issues, the use of undocumented and untested manufacturing processes and poor control of manufacturing materials, among other factors.

Congress and DOD have taken steps in recent years to address concerns over MDA's acquisition management strategy, accountability, and oversight. These include efforts to provide more information on cost, schedule, and other baselines; efforts to prevent quality problems; and efforts to begin obtaining independent cost estimates.

⁹[GAO-11-372](#), [GAO-12-720R](#), and [GAO-13-432](#).

¹⁰[GAO-13-432](#), [GAO-12-486](#), and [GAO-11-372](#).

¹¹[GAO-11-404](#).

MDA Has Made Progress on Testing, Reducing Some Acquisition Risks, and Improving the Clarity of the Baselines

In April 2013, we reported that in the past year MDA gained important knowledge through its test program, including successfully conducting its most complex integrated air and missile defense flight test to date, and it took some positive steps to reduce acquisition risks for two of its programs. It has also improved the clarity of baseline information it reports to Congress.¹²

Specifically, in April 2013 we reported that in October 2012, MDA conducted the largest integrated air and missile defense flight test to date, achieving near simultaneous intercepts of multiple targets by various BMDS interceptors. This test was a combined developmental and operational flight test that for the first time used warfighters from multiple combatant commands and employed multiple missile defense systems. All five targets—three ballistic and two cruise missiles—were launched and performed as expected. In this test, THAAD also intercepted a medium range target for the first time and an Aegis ship conducted successfully a standard missile-2 Block IIIA engagement against a cruise missile. This test also provided valuable data to evaluate interoperability between several systems during a live engagement.

In April 2013, we reported that in fiscal year 2012, the Aegis BMD SM-3 Block IB and THAAD programs also attained important knowledge in their flight test programs. In May 2012, the Aegis BMD SM-3 Block IB system intercepted a short-range target for the first time. In June 2012, the system completed another successful intercept which provided more insight into the missile's enhanced ability to discriminate the target from other objects during an engagement. In October 2011, THAAD successfully conducted its first operational flight test prior to entering full-rate production.¹³ During the test, THAAD fired two missiles that intercepted two short-range targets, demonstrating that the system can perform under operationally realistic conditions from mission planning through the end of the engagement. Additionally, this test supported the resumption of interceptor manufacturing, and was used by the Army as support for accepting the first two THAAD batteries. This also marked the

¹²[GAO-13-432](#).

¹³Pursuant to MDA's acquisition flexibilities, once an element enters the production and deployment phase, the element enters the formal DOD acquisition system. Consequently, 10 U.S.C. § 2366 requires completion of realistic survivability testing of a weapon system before a program can begin full-rate production.

first time Army and DOD test and evaluation organizations confirmed that the test and its results resembled the fielded system.

We also reported in April 2013 that MDA took steps to reduce acquisition risk by decreasing the overlap between technology and product development for two of its programs—the Aegis BMD SM-3 Block IIA and Block IIB programs.¹⁴ By taking steps to reconcile gaps between requirements and available resources before product development begins, MDA makes it more likely that programs can meet cost, schedule, and performance targets. The Aegis BMD SM-3 Block IIA program added time and money to extend development following significant problems with four components. MDA reduced its acquisition risk by delaying the program's system preliminary design review for more than one year and, as a result, in March 2012, the program successfully completed the review because it allowed additional development of the components. We also reported in April 2013 that the Aegis BMD SM-3 Block IIB program had taken important steps to reduce concurrency and increase the technical knowledge it planned to achieve before development by delaying product development until after its preliminary design review was completed.

Lastly, in April 2013 we reported that MDA has taken steps to improve the clarity of its acquisition baselines since we reported on these issues in March 2011. Although MDA is not yet required to establish an acquisition program baseline pursuant to 10 U.S.C. § 2435 and related DOD policy because of the acquisition flexibilities it has been granted, Congress has enacted legislation requiring MDA to establish some baselines. MDA reported baselines for several BMDS programs to Congress for the first time in its June 2010 BMDS Accountability Report (BAR) to respond to statutory requirements in the National Defense Authorization Act for Fiscal Year 2008.¹⁵ MDA's baselines, including resource and schedule baselines, are reported in the BAR and are updated annually. MDA's 2012 resource baselines report costs for all the categories of the life cycle—research and development, procurement, military construction,

¹⁴[GAO-13-432](#).

¹⁵Pub. L. No. 110-181, § 223(g), *repealed by* Pub. L. No. 112-81, § 231(b) (2011).

operations and support, and disposal costs.¹⁶ Schedule baselines include key milestones and tasks, such as important decision points, significant increases in performance knowledge, modeling and simulation events, and development efforts. Some also show time frames for flight and ground tests, fielding, and events to support fielding.

In its 2012 BAR, MDA made several useful changes to its reported resource and schedule baselines in response to our concerns and congressional direction. For example, MDA

- reported the full range of life cycle costs borne by MDA;
- defined and explained more clearly what costs are in the resource baselines or were excluded from the estimates;
- included costs already incurred in the unit cost for Targets and Countermeasures so they were more complete;
- added a separate delivery table that provided more detailed information on deliveries and inventories; and
- added a list of significant decisions made or events that occurred in the past year—either internal or external to the program—that affected program progress or baseline reporting.

MDA Continues to Face a Variety of Acquisition Challenges

Although the MDA has made some progress, the new MDA Director faces considerable challenges in executing acquisition programs; strengthening accountability; assessing alternatives before making new investment commitments; developing and deploying U.S. missile defense in Europe and using modeling and simulations to understand capabilities and limitations of the BMDS.

¹⁶Research and development costs include development and design costs for system engineering and design, test and evaluation, and other costs for system design features. Procurement costs include total production and deployment costs (e.g., site activation, training) of the prime system and its related support equipment and facilities. Military construction costs include costs for major construction such as bases and buildings. Operations and support costs include costs of operating and supporting the fielded system, including all direct and indirect costs incurred in using the system (e.g., personnel, maintenance, and sustaining investment). Disposal, or inactivation, costs include the costs of disposing of the prime equipment after its useful life.

Challenge: Executing Acquisition Programs

In April 2013 we reported that though MDA has gained important insights through testing and taken some steps to reduce acquisition risk and increase transparency, it still faces challenges stemming from high-risk acquisition strategies. As noted earlier, MDA has undertaken and continues to undertake highly concurrent acquisitions. While some concurrency is understandable, committing to product development before requirements are understood and technologies are mature or committing to production and fielding before development is complete is a high-risk strategy that often results in performance shortfalls, unexpected cost increases, schedule delays, and test problems. It can also create pressure to keep producing to avoid work stoppages.

Our April 2012 report detailed how the Aegis BMD SM-3 Block IB, GMD, and THAAD programs undertook highly concurrent acquisition strategies.¹⁷ For example, to meet the presidential directive to deploy an initial set of missile defense capabilities by 2004, the GMD program concurrently matured technology, designed the system, tested the design, and produced and deployed an initial set of missile defense capabilities. CE-I interceptors were rapidly delivered to the warfighter but they required an expensive retrofit and refurbishment program that is still ongoing. Similarly, MDA proceeded to concurrently develop, manufacture, and deliver 12 of the next generation of interceptors, the CE-IIs. They were also delivered prematurely to the warfighter and will require an extensive and expensive retrofit.

In April 2012, we also reported that the Aegis Ashore and PTSS programs were adopting acquisition strategies with high levels of concurrency. The Aegis Ashore program, for instance, began product development on two systems—one designated for testing and the other operational—and set the acquisition baseline before completing the preliminary design review. Best practices, by contrast, call for such baselines to be set after this review because the review process is designed to ensure the program has sufficient knowledge about resources and requirements before engaging in large-scale acquisition activities. Similarly, for its new PTSS, MDA planned to develop and produce two industry-built satellites while a laboratory-led contractor team was still in the development phase of building two lab development satellites. Such an approach would not enable decision makers to fully

¹⁷[GAO-12-486](#).

benefit from the knowledge about the design to be gained from on-orbit testing of the laboratory-built satellites before committing to the next industry-built satellites.

In our April 2013 report, we noted that the concurrent high risk approaches for the GMD and Aegis BMD SM-3 Block IB programs were continuing to have negative effects, while the THAAD program was able to overcome most of its issues.¹⁸ For instance, discovery of the CE-II design problem while production was already under way increased MDA costs to demonstrate and fix CE-II capability from approximately \$236 million to over \$1.2 billion, due to the costs of additional flight tests including the target and test-range, investigating the failure, developing failure resolutions, and fixing the already delivered missiles. Costs continue growing because MDA further delayed the next intercept test planned for fiscal year 2012. At this time, the next intercept test date is not yet determined as MDA is considering various options. While the Aegis BMD SM-3 Block IB program slowed production to address developmental issues that arose when the program experienced a failure and a flight anomaly in early flight tests, it experienced further difficulties completing testing of a new maneuvering component—contributing to delays for a third flight test needed to validate the interceptor’s capability.

We also reported in April 2013 that MDA was continuing to follow high risk acquisition strategies for its Aegis Ashore, PTSS, and Targets and Countermeasures programs. For example, this year we reported that the Targets and Countermeasures acquisition strategy is adding risk to an upcoming complex, costly operational flight test involving multiple MDA systems because it plans to use unproven targets. Using these new targets puts this major test at risk of not being able to obtain key information should the targets not perform as expected. Developmental issues with this new medium-range target as well as identification of new software requirements have already contributed to delaying the test, which was originally planned for the fourth quarter of fiscal year 2012 and is now planned for the fourth quarter of fiscal year 2013.

In 2012, we recommended MDA make adjustments to the acquisition schedules to reduce concurrency.¹⁹ DOD agreed and partially addressed

¹⁸ [GAO-13-432](#).

¹⁹ [GAO-12-486](#).

the recommendation. Specifically, MDA reduced concurrency in the Aegis BMD SM-3 Block IIA and Block IIB programs, but continues to include high levels of concurrency in other programs as discussed above. We also recommended in 2013 that the Secretary of Defense direct MDA's new Director to add non-intercept flight tests for each new type of target missile developed to reduce risk.²⁰ DOD partially concurred, stating that the decision to perform a non-intercept target test must be balanced against cost, schedule and programmatic impacts. While there may be exceptions that need to occur when there is a critical warfighter need, we believe, whenever possible, that MDA should avoid using undemonstrated targets, particularly for costly and complex major operational tests.

Challenge: Strengthening Accountability by Ensuring Program Baselines Support Oversight

In April 2013 we reported that while MDA made substantial improvements to the clarity of its reported resource and schedule baselines in fiscal year 2012, it has made little progress improving the quality of its cost estimates that support its resource baseline since we made a recommendation to improve these estimates in our March 2011 report.²¹ In particular, MDA's resource baselines are not yet sufficiently reliable, in part because they do not include costs from military services in reported life cycle costs for its programs. Instability due to MDA's frequent adjustments to its acquisition baselines also makes assessing progress over time extremely difficult and, in many cases, impossible. Despite some positive steps forward since 2004, the baselines are of limited use for meaningfully assessing BMDS cost and schedule progress.

In our March 2011 report, we assessed MDA life cycle cost estimates using the GAO Cost Estimating and Assessment Guide.²² We found that the cost estimates we assessed, that were used to support MDA's resource baselines, were not comprehensive, lacked documentation, were not completely accurate, or were not sufficiently credible. In April 2013 we reported that, in June 2012, MDA completed an internal Cost Estimating Handbook, largely based on our guide which, if implemented, could help address nearly all of the shortfalls we identified. Because the

²⁰[GAO-13-432](#).

²¹[GAO-11-372](#).

²²[GAO-11-372](#) and GAO, *GAO Cost Estimating and Assessment Guide*, [GAO-09-3SP](#) (Washington, D.C.: March 2009).

Handbook was only recently completed, it is too early to assess whether the quality of MDA's cost estimates have improved. In our April 2013 report, we found that while the agency made improvements to its reported resource baselines to include all of the life cycle costs funded by MDA from development through retirement of the program, the baselines do not include operation and support costs funded by the individual military services.²³ According to our guide, cost estimates should be comprehensive. Comprehensive estimates include both the government and contractor costs of the program over its full life cycle, from inception of the program through design, development, deployment, and operation and support to retirement. MDA officials told us in 2011 that MDA does not consider military service operation and support funds to be part of the baselines because the services execute the funds. It is unclear what percentage operation and support costs are in the case of MDA programs because they have not been reported. For programs outside of MDA these costs can be significant, and as a result the reported life cycle costs for some MDA programs could be significantly understated.

In our April 2013 report, we recommended that the Secretary of Defense direct MDA's new Director to include in its resource baseline cost estimates all life cycle costs, specifically the operations and support costs from the military services in order to provide decision makers with the full costs of ballistic missile defense systems. DOD partially concurred with this recommendation, agreeing that decision makers should have insight into the full life cycle costs of DOD programs, but disagreeing that they should be reported in MDA's BAR. DOD did not identify how the full life cycle costs should be reported. We continue to believe that these costs should be reported because good budgeting requires that the full costs of a project be considered when making decisions to provide resources. In addition, DOD has reported full operation and support costs to Congress for major defense acquisition programs where one military service is leading the development of an acquisition planned to be operated by many military services. We also believe that MDA's BAR is the most appropriate way to report the full costs to Congress because it already includes the acquisition costs and the MDA funded operation and support costs.

²³[GAO-13-432](#).

In July 2012, we also used our Schedule Assessment Guide to assess five MDA program schedules that support the baselines and found that none fully met the best practices identified in the guide.²⁴ For example, three programs took steps to ensure resources were assigned to their schedule activities, but one program did not do so and the other only partially did so. Moreover, none of the five programs we reviewed had an integrated master schedule for the entire length of acquisition as called for by the first best practice, meaning the programs are at risk for unreliable completion estimates and delays. DOD concurred with our recommendations to ensure that best practices are applied to those schedules as outlined in our guide, and MDA programs have taken some actions to improve their schedules, though they have not yet had time to fully address our recommendations. We plan to continue to monitor their progress because establishing sound and reliable schedules is fundamental to creating realistic schedule and cost baselines.

Lastly, as we reported in March 2009, in order for baselines to be useful, they need to be stable over time so progress can be measured and so that decision makers can determine how to best allocate limited resources.²⁵ In April 2013, we reported that most major defense acquisition programs are required to establish baselines prior to beginning product development.²⁶ These baselines, as implemented by DOD, include key performance, cost, and schedule goals. Decision makers can compare the current estimates for performance, cost, and schedule goals against a baseline in order to measure and monitor progress. Identifying and reporting deviations from the baseline in cost, schedule, or performance as a program proceeds provides valuable information for oversight by identifying areas of program risk and its causes.

However, as we reported in April 2013, MDA only reports annual progress by comparing its current estimates for unit cost and scheduled activities

²⁴[GAO-12-720R](#).

²⁵[GAO-09-3SP](#).

²⁶A baseline description for a major defense acquisition program or any designated major subprogram under the program shall be prepared ... before the program or subprogram enters system development and demonstration; before the program or subprogram enters production and deployment, and before the program or subprogram enters full rate production. 10 U.S.C. § 2435.

against the prior year's estimates. As a result, MDA's baseline reports are not useful for tracking longer term progress. When we sought to compare the latest 2012 unit cost and schedule estimates with the original baselines set in 2010, we found that because the baseline content had been adjusted from year to year, in many instances the baselines were no longer comparable. I would like to highlight the problems we identified in Aegis Ashore to illustrate how these adjustments limited visibility into cost or schedule progress. MDA prematurely set the Aegis Ashore baseline before program requirements were understood and before the acquisition strategy was firm. The program has subsequently added significant content to the resource baseline to respond to acquisition strategy changes and requirements that were added after the baseline was set. In addition, activities from Aegis Ashore's 2010 BAR schedule baseline were split into multiple events, renamed, or eliminated altogether in the program's 2012 BAR schedule baseline. MDA also redistributed planned activities from the Aegis Ashore schedule baselines into several other Aegis BMD schedule baselines. These major adjustments in program content made it impossible to understand annual or longer-term program cost progress. Rearranging content to other baselines also made tracking the progress of these activities very difficult and in some cases impossible.

We recommended in our April 2013 report that the Secretary of Defense direct MDA's new Director to stabilize the acquisition baselines so that meaningful comparisons can be made over time that support oversight of those acquisitions. DOD concurred with this recommendation.

Other Challenges Reported by GAO

Our April 2013 report discussed a variety of other challenges facing MDA that I would like to highlight today. First, in light of growing fiscal pressures, it is becoming increasingly important that MDA have a sound basis before investing in new efforts. But MDA has not analyzed alternatives in a robust manner before making recent commitments. Second, during the past several years, MDA has been responding to a mandate from the President to develop and deploy new missile defense systems in Europe for defense of Europe and the United States. Our work continues to find that a key challenge facing DOD is to keep individual system acquisitions synchronized with the planned time frames of the overall U.S. missile defense capability planned in Europe. Third, MDA also is challenged by the need to develop the tools—the models and simulations—to understand the capabilities and limitations of the individual systems before they are deployed, which will require the agency to overcome technical limitations in the current approach to

Analyses of Alternatives Could
Help MDA Balance and
Prioritize Its Portfolio of
Investments

modeling missile defense performance. While MDA recently committed to a new approach in modeling and simulation that could enable them to credibly model individual programs and system-level BMDS performance, warfighters will not benefit from this effort until two of the currently planned three phases for U.S. missile defense in Europe have already been deployed in 2011 and 2015 respectively.

Because MDA faces growing fiscal pressure as it develops new programs at the same time as it supports and upgrades existing ones, DOD and MDA face key challenges getting the best value for its missile defense investments. We have frequently reported on the importance of establishing a sound basis before committing resources to developing a new product.²⁷ We have also reported that part of a sound basis is a full analysis of alternatives (AOA).²⁸ The AOA is an analytical study that is intended to compare the operational effectiveness, cost, and risks of a number of alternative potential solutions to address valid needs and shortfalls in operational capability. A robust AOA can provide decision makers with the information they need by helping establish whether a concept can be developed and produced within existing resources and whether it is the best solution to meet the warfighter's needs. Major defense acquisition programs are generally required by law and DOD's acquisition policy to conduct an AOA before they are approved to enter the technology development phase. Because of the flexibilities that have been granted to MDA, its programs are not required to complete an AOA before starting technology development. Nevertheless, MDA's acquisition directive requires programs to show they have identified competitive alternative materiel solutions before they can proceed to MDA's technology development phase. However, this directive provides no specific guidance on how this alternatives analysis should be conducted or what criteria should be used to identify and assess alternatives, such as risks and costs.

²⁷ [GAO-08-1113](#); *Defense Acquisitions: Improved Business Case Is Needed for Future Combat System's Successful Outcome*, [GAO-06-367](#) (Washington, D.C.: Mar. 14, 2006); and *Tactical Aircraft: Air Force Still Needs Business Case to Support F/A-22 Quantities and Increased Capabilities*, [GAO-05-304](#) (Washington, D.C.: Mar. 15, 2005).

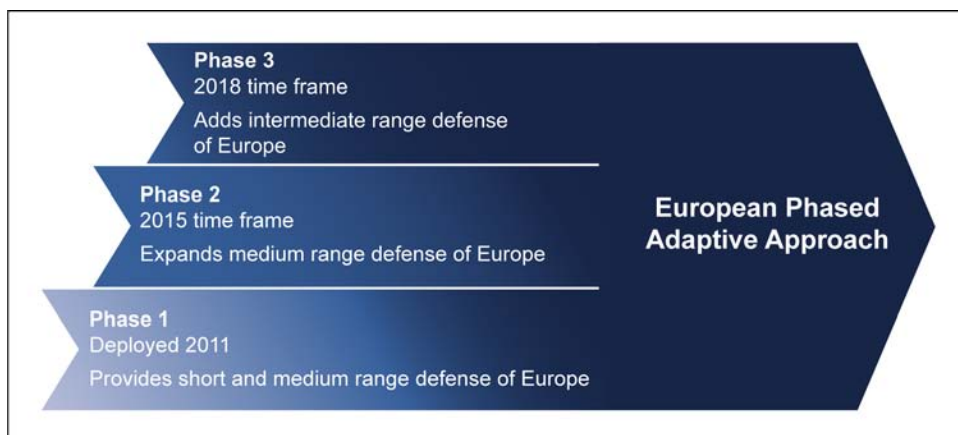
²⁸ [GAO-09-665](#) and *Homeland Security: DHS Requires More Disciplined Investment Management to Help Meet Mission Needs*, [GAO-12-833](#) (Washington, D.C.: Sept. 18, 2012).

We reported in February 2013 that the Aegis BMD SM-3 Block IIB had not conducted a robust alternatives analysis and also reported in April 2013 that MDA did not conduct robust alternatives analyses for the PTSS program. Both of these programs were recently proposed for cancellation in the Fiscal Year 2014 President's Budget Submission. In our April 2013 report, we recommended that the Secretary of Defense direct the new MDA Director to undertake robust alternatives analyses for new major missile defense efforts currently underway and before embarking on other new missile defense programs. Doing so can help provide a foundation for developing and refining new program requirements, understanding the technical feasibility and costs of alternatives and help decision makers determine how to balance and prioritize MDA's portfolio of BMDS investments. DOD concurred with our recommendation but asserted MDA already performs studies and reviews that function as analyses of alternatives. We have found, however, that these studies are not sufficiently robust.

Developing and Deploying U.S. Missile Defense in Europe

In September 2009, the President announced a new approach to provide U.S. missile defense in Europe. This four-phase effort was designed to rely on increasingly capable missiles, sensors, and command and control systems to defend Europe and the United States. In March 2013, the Secretary of Defense canceled Phase 4, which called for Aegis BMD SM-3 Block IIB interceptors, and announced several other plans, including deploying additional ground based interceptors in Fort Greely, Alaska, and deploying a second AN/TPY-2 radar in Japan. DOD declared the first phase of U.S. missile defense in Europe operational in December 2011. The current three-phase effort is shown in figure 1.

Figure 1: Three-Phase U.S. Approach to Missile Defense in Europe



Source: GAO analysis of President's September 17, 2009, policy announcement, Secretary of Defense briefing on Missile Defense on March 15, 2013, and MDA and DOD data.

We reported in April 2012 that in order to meet the 2009 presidential announcement to deploy missile defenses in Europe, MDA has undertaken and continues to undertake highly concurrent acquisitions. We reported in April 2013 that, according to MDA documentation, system capabilities originally planned for the first three phases are facing delays, either in development or in integration and testing.

- The systems delivered for Phase 1 do not yet provide the full capability planned for the phase. Phase 1 was largely defined by existing systems that could be quickly deployed because of the limited time between the September 2009 announcement and the planned deployment of the first phase in 2011. MDA planned to deploy the first phase in two stages—the systems needed for the phase and then upgrades to those systems in 2014. However, an MDA official told us that MDA now considers the system upgrades stage to be part of the second phase, which may not be available until the 2015 time frame.
- For Phase 2, some capabilities, such as an Aegis weapon system software upgrade, may not yet be available. MDA officials stated they are working to resolve this issue.
- For Phase 3, some battle management and Aegis capabilities are currently projected to be delayed.
- We recommended in our April 2012 report that DOD review the extent to which capability delivery dates announced by the President in 2009 were contributing to concurrency in missile defense acquisitions and identify schedule adjustments where significant benefits could be

Modeling and Simulation Limitations

obtained by reducing concurrency. DOD concurred with this recommendation.

We reported in April 2013 that a key challenge for both the Director of MDA and the warfighter is understanding the capabilities and limitations of the systems MDA is going to deploy, particularly given the rapid pace of development. According to MDA's Fiscal Year 2012 President's Budget Submission, models and simulations are critical to understanding BMDS operational performance because assessing performance through flight tests alone is prohibitively expensive and can be affected by safety and test range constraints.²⁹ In August 2009, U.S. Strategic Command and the BMDS Operational Test Agency jointly informed MDA of a number of system-level limitations in MDA's modeling and simulation program that adversely affected their ability to assess BMDS performance. Since then, we reported in March 2011 and again in April 2012 that MDA has had difficulty developing its models and simulations to the point where it can assess operational performance. In April 2013, we reported that MDA recently committed to a new approach in modeling and simulation that officials stated could enable them to credibly model individual programs and system-level BMDS performance by 2017.³⁰ To accomplish this, MDA will use only one simulation framework, not two, to do ground testing and performance assessments. With one framework, the agency anticipates data quality improvements through consistent representations of the threat, the environment, and communications at the system level. Without implementing these changes, MDA officials told us it would not be possible to credibly model BMDS performance by 2017, in time to assess the third phase of U.S. missile defense in Europe.

MDA program officials told us that the next major assessment of U.S. missile defense in Europe for the 2015 deployment will continue to have many of the existing shortfalls. As a result, MDA is pursuing initiatives to improve confidence in the realism of its models in the near term, one of

²⁹A model is a representation of an actual system that involves computer simulations that can be used to predict how the system might perform or survive under various conditions or in a range of hostile environments. A simulation is a method for implementing a model. It is the process of conducting experiments with a model for the purpose of understanding the behavior of the system modeled under selected conditions or of evaluating various strategies for the operation of the system within the limits imposed by developmental or operational criteria. Simulation may include the use of digital devices, laboratory models, or "test bed" sites.

³⁰[GAO-13-432](#).

which involves identifying more areas in the models where credibility can be certified by the BMDS Operational Test Agency. Another focuses on resolving the limitations identified jointly by the Operational Test Agency and U.S. Strategic Command. Lastly, MDA officials told us they are refining the process used to digitally recreate system-level flight tests in order to increase confidence in the models.

Because MDA recently committed to a new approach for modeling and simulation, we did not make recommendations in our 2013 report. However, it is important that this effort receive sufficient management attention and resources, given past challenges and the criticality of modeling and simulation.

In conclusion, many of the challenges I have highlighted today are rooted in both the schedule pressures that were placed on MDA when the agency was directed in 2002 to rapidly field an initial missile defense capability and the flexibilities that were granted MDA so that it could do so. Today, however, initial capability is in place; MDA has begun to transition more mature systems to the military services; it has had to propose canceling two major efforts in the face of budget reductions, concerns about affordability, and technical challenges; and the employment of BMDS systems is becoming increasingly interdependent, thereby increasing the potential consequences of problems discovered late in the development cycle. In recent years, both Congress and MDA have recognized that conditions have changed and steps need to be taken that reduce acquisition risk, while increasing transparency and accountability. However, especially in light of growing budget pressures, additional actions are needed, including

- sufficiently analyzing alternatives before making major new investment commitments;
- stabilizing acquisition baselines and ensuring they are comprehensive and reliable;
- ensuring acquisition strategies allow for the right technical and programmatic knowledge to be in place before moving into more complex and costly phases of development; and
- demonstrating new types of targets in less critical tests before they are used in a major test in order to lower testing risks

The appointment of a new Director provides an opportunity to address these challenges, but doing so will not be easy as MDA is still under

significant schedule pressures and the agency is undergoing a transition to respond to new Secretary of Defense direction to expand the GMD capabilities. As such, we look forward to continuing to work with MDA to identify and implement actions that can reduce acquisition risk and facilitate oversight and better position MDA to respond to today's demands.

Chairman Udall, Ranking Member Sessions, and Members of the Subcommittee, this concludes my statement. I am happy to answer any questions you have.

GAO Contact and Staff Acknowledgments

For future questions about this statement, please contact me at (202) 512-4841 or chaplainc@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. Individuals making key contributions to this statement include David B. Best, Assistant Director; Aryn Ehlow; Ivy Hübler; Meredith Allen Kimmett; Wiktor Niewiadomski; Kenneth E. Patton; John H. Pendleton; Karen Richey; Brian T. Smith; Steven Stern; Robert Swierczek; Brian Tittle; and Hai V. Tran.

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